

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/NZ05/000060

International filing date: 29 March 2005 (29.03.2005)

Document type: Certified copy of priority document

Document details: Country/Office: NZ
Number: NZ 532006
Filing date: 29 March 2004 (29.03.2004)

Date of receipt at the International Bureau: 19 April 2005 (19.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

PCT/NZ2005/000060

CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 29 March 2004 with an application for Letters Patent number 532006 made by Rodney Warwick Sharp.

Dated 11 April 2005.



Neville Harris
Commissioner of Patents, Trade Marks and Designs



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PATENTS ACT 1953

PROVISIONAL SPECIFICATION

Title *Improvements in and Relating to Teeth for Grinding Apparatus*

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Nationality: A New Zealand citizen

do hereby declare this invention to be described in the following statement:

IMPROVEMENTS IN AND RELATING TO TEETH FOR GRINDING APPARATUS

FIELD OF INVENTION

The present invention relates to replaceable teeth assembly for use in grinding and chipping operations. Generally such teeth are mounted in grinding discs and drums. Typical uses
5 include breaking down and chipping wood or other materials.

BACKGROUND DESCRIPTION

The present invention has been developed with problems associated with the comminution of wood and timber materials in mind. It should be appreciated that the principles of the present invention may be extended for use in apparatus which breaks down other types of
10 material. However for simplicity of description the problems associated with the wood and timber industry shall be focused upon.

A good example of comminution equipment for breaking down wood and timber material are wood hoggers, reducers, and chippers. Each of these are fed various types of wood and timber material, which are then broken into smaller size pieces. Typically grinding discs or
15 drums are used in a variety of types and designs of apparatus for comminuting wood material. Typically these bear a plurality of teeth like protuberances which impact with the wooden material.

However, in practice, high wear is often seen. Some types of wood hoggers (which is a device typically for breaking down waste timber material into a low grade fuel called hog
20 fuel) can suffer quite high wear due to continued contact with the material being processed. Accordingly most modern designs of grinding discs and drums have replaceable teeth as opposed to teeth which are formed, welded, or otherwise cast into the main body of the drum or disc.

A further problem associated with wear is damage caused by impact with foreign material. Quite commonly steel and rocks may find their way into wood hogging apparatus (for
25 instance) and cause severe damage to teeth. The teeth may need to be replaced and ideally this should be able to be completed as quickly as possible to avoid extended down periods for the apparatus while repairs or maintenance are performed.

The problem with most prior art tooth designs are that while the tooth design is quite simple, the holder is relatively complex in design. The problem here is that they are more expensive to produce (though the replacement teeth may be relatively inexpensive) and often require discs and drums of specific design to be prepared so that the complex tooth holders can be fitted. This adds to the overall cost of constructing the original apparatus.

It is also common to find that the wear of teeth is predominately on one side, as most apparatus is designed to rotate in one particular direction only. Most current designs do not allow the orientation of the teeth or disc to be easily or quickly changed.

Accordingly there is a need in the industry for an alternative design which allows teeth, for use in grinding discs and drum, to be simply fitted, easily changed, and ideally also being able to be easily rotated to allow both sides of the tooth to be exposed to wear.

It is an object of the present invention to provide an improved replaceable tooth design which does not require a complex holder assembly for fitting to at least a grinding disc or port thereof.

It is an object of the present invention to address the problems of the prior art.

At the very least it is an object of the present invention to provide the public with a useful alternative.

GENERAL DESCRIPTION OF THE INVENTION

According to one aspect of the present invention there is provided a replaceable tooth arrangement comprising a tip portion with associated tooth, and provision to connect said tip portion to a base portion.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the base portion comprises another tip portion.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the base portion comprises a body portion adapted to interact with securing means for its attachment to a device in which the tooth is to be used.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the device is a grinding or chipping disc or drum.

- 5 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the device is a section making up a grinding or chipping disc or drum.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the main body of the tip portion, when viewed in plan, is substantially circular.

- 10 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the main body of the tip portion, when viewed in plan, is substantially polygonal.

- 15 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the tooth is welded or bonded to the main body of the tip portion.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the tooth is integrally formed with the main body of the tip portion.

- 20 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the tooth is chisel like in configuration.

- 25 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the main body of the base portion is of comparable cross-section to the main body of the tip portion, when they are viewed in plan.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the bottom face of the main body of the tip portion is inclined.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the top face of the main body of the base portion is comparably inclined.

- 5 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which pushing the tip portion and base portions together causes some lateral movement to accompany any longitudinal movement.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which said provision for connecting said tip portion to a base portion comprises a bolt.

- 10 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the bolt where it sits with respect to the tip portion, sits on a contoured keeper.

- 15 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which contacting walls of the keeper with the body of the tip portion are inclined and complementary to an accommodating recess in the body of the tip portion.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the keeper and the accommodating recess are adjacent and open on to a side wall of the body of the tip portion.

- 20 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the relationship between keeper and body of the tip portion is such that moving the keeper in a downward direction also induces an outward lateral movement of the keeper.

- 25 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which the connecting means for connecting the tip portion and base portion is a bolt and optionally nut assembly.

According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which, when the base portion is an

equivalent tip portion, the bolt passes through and tightens both together in a longitudinally adjacent manner.

5 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which, when the base portion is a body portion with securing means, the bolt connects to a laterally oriented retaining pin positioned in the body portion.

10 According to another aspect of the present invention there is provided a replaceable tooth arrangement, substantially as described above, in which said laterally oriented retaining pin is also the securing means for the base portion to the device with which it is intended to be used.

According to a further aspect of the present invention there is provided a tooth assembly comprising a replaceable tooth arrangement, substantially as described above, in combination with a base portion.

15 According to another aspect of the present invention there is provided a tooth assembly, substantially as described above, in which the base portion is a substantially identical replaceable tooth arrangement secured longitudinally end to end.

20 According to another aspect of the present invention there is provided a tooth assembly, substantially as described above, in which the base portion is a body element including means for securing the combination to a device such as a grinder disc, grinding drum, or a part thereof.

According to a further aspect of the present invention there is provided a grinding disc or drum including a tooth assembly substantially as described above.

According to a further aspect of the present invention there is provided a grinding disc or drum including a replaceable tooth arrangement, substantially as described above.

25 The present invention includes a tooth arrangement which may be fitted to at least one other component or assembly to provide a replaceable tooth arrangement. This other component or assembly may take a number of forms according to the intended application of the present invention. Hence in its simplest form the present invention will comprise a tip portion while in another form it may comprise a tooth arrangement including at least one tip portion.

It is perhaps best to describe the tip portion first. Typically this will comprise a tooth element which is attached, connected, or formed into a tip body portion. In most cases it is envisaged that this tip portion will not be able to be used on its own and will require attachment to another component or assembly, which shall be referred to as the base portion, before it can be used on most types of grinding or breaking apparatus. This is the case for preferred embodiments, but need not necessarily be the case in every instance.

The tip portion is generally also characterised by including provision for its attachment to the base portion. While this may take a number of forms the preferred arrangement is to allow at least one bolt to pass through the tip body portion for securing to the base portion. Generally this is substantially longitudinally with respect to the body of the tip portion. In practice, also, this bolt will absorb some of the energy of impacts of the tooth against hard and foreign materials. If sufficiently severe the bolt will typically be sacrificed rather than the tooth body.

While in its simplest form the provision for a connecting bolt may simply comprise an aperture through the tip body portion, and a suitable face for seating the bolt, preferred embodiments have a tapered keeper to further improve the performance of the present invention. This keeper is typically a wedge or tapered element which, if moved downwardly with respect to the tip body portion, will also be moved slightly outwardly. This may be achieved by providing suitably inclined faces on both the keeper and on the walls of recessed portions of the tip body portion for accommodating the keeper. In practice this keeper will be intermediate the head of the bolt (or a nut) and the tip body portion. In practice also, the tip body portion, and keeper, will be inserted into a suitable locating aperture in a grinding disc, drum, or part thereof. Once inserted, outward movement of the keeper would not be permitted. Hence attempted downward movement of the keeper, by the retaining bolts, will in fact cause the keeper to wedge more tightly within the recess defined by the inclined recess walls of the tip body portion, and against the wall of the aperture into which the tip portion with keeper has been inserted. This very effectively tightens the whole arrangement within the provided locating aperture to ensure that there is no slack, or loose movement.

In preferred embodiments of the present invention the bottommost face of the tip portion is tapered though the invention in its broadest form includes a bottom face substantially perpendicular to the longitudinal axis. This again can provide for a number of other

potentially realisable advantages or features. The preferred degree of tapering is 15° - 75° inclusive of the longitudinal axis, and more preferably 30° - 60° inclusive. This taper also allows for energy transmission and some absorption, due to relative movement, should a tooth or tip portion be subjected to a high impact. This can preserve the life of a tip portion under normal or adverse conditions.

For instance, this tapering will allow two identical tip portions to be placed longitudinally end to end, with one of the two tip portions affectively acting as a base portion for the other. In such a case tightening the connecting bolt (associated with the keeper) will serve to draw the two tip portions towards each other. The tapering of their contacting faces again causes them to move slightly laterally as well as towards each other. Again, when the assembly is placed within a locating aperture within a grinding disc or such like, tightening of the bolt really serves to further tighten the assembly within the aperture. This is particularly important in a situation where the assembly is being mounted into an aperture connecting, say, front and rear faces of the disc. Here the only means by which the components may be held in place (depending on the embodiment) may be by outward pressure of the inserted components against the sides of the locating aperture in which the assembly is fitted, as a consequence of the retaining bolt being tightened.

As another variation the base portion may comprise merely a body portion able to be connected to a grinding disc, drum, or part thereof. In the preferred embodiment this base portion merely comprises a blind wedge whose top face is contoured to match the bottom face of the other tip portion. Suitable means for connection of this base portion to the grinding disc, etc, should be provided. This may merely comprise a threaded aperture into which a bolt may be tightened from outside. However, in a preferred embodiment there is a provided an aperture in the body of the base portion through which a pin may be passed. This pin may have a threaded aperture within it so that once having passed through the grinding disc (or part thereof etc) and through the body of the base portion itself, the retaining bolt for the tip portion can be inserted into the threaded aperture and tightened. As a result the assembly, and tip portion, is tightly secured against removal from the locating aperture for the assembly, as well as being prevented from rotation within the locating aperture provided for the assembly.

Construction of the various components may vary. For ease of construction, and economy, it is considered that the majority of components may be cast, and preferably of a suitably hard material. The tip portion generally has the highest requirement, and particularly the tooth portion thereof. Consequently the tooth portion may be manufactured separately and subsequently fastened to the tip portion, or alternatively the entire tip portion may be cast as one. The actual tooth portion may then be machined, according to user preference, to achieve the appropriate contours and sharpness of edges which may be desirable for a tooth. In preferred embodiments high strength and high hardness steels are used for the tooth portion, with the entire tip portion with tooth portion then cast as one unit. Other components which may be subjected to less wear may be formed of other types of steel or materials.

In preferred embodiments of the present invention the main body of the tip portion, and also the main body formed by the union of the tip portion with base portion, is preferably circular in cross section. By utilising a circular cross section, the accommodating aperture within the grinding disc (or drum etc) may be easily formed by drilling a suitably sized aperture. While other shapes may be provided for in various other embodiments and need not be of constant cross-section, this increases the difficulty of forming the appropriately shaped aperture within the grinding disc etc. However, this does not preclude their use - non circular (cross-section) embodiments would be less likely to rotate within the aperture.

It is also possible in certain embodiments that keyed features may be provided in the various body portions and/or accommodating recess/apertures in the grinding disc etc. This is particularly useful if one is attempting to prevent rotation of the replaceable tooth assembly. While certain embodiments such as those having a blind wedge and lateral pin as a base portion are resistant to rotation, other arrangements are not necessarily so. One example is where two tip portions are used end to end. Here various recesses for insertion of a key, or key and recessed features may be provided in either or both of the body portions and/or the locating apertures in the grinding disc (etc). It is considered that in most applications where end to end tip portions are used, tightening the bolt (with the components being subsequently forced against the aperture walls) will be sufficient to prevent rotation under normal conditions. However it is also envisaged that there may be applications where the additional security of the keyed arrangement may be required.

Various modifications may be made to different embodiments of the invention. For instance, the locating aperture for a tooth assembly need not be at 90° to the surface from which it protrudes. It may be angled, preferably so that the tooth end faces into the direction of travel. This can further improve resistance to impacts.

- 5 Locating apertures for the tooth arrangement need not be substantially cylindrical and may adopt other configurations including, but not restricted to, conical, parabolic in side section, hyperbolic in side section, or parts thereof.

DESCRIPTION OF DRAWINGS

10 Figure 1 is an exploded diagrammatic view of one preferred embodiment of the present invention,

Figure 2 is an exploded diagrammatic view of an alternative arrangement of the present invention utilising the tip portion of figure 1,

Figure 3 is a perspective diagrammatic view of the embodiment of figure 2,

Figure 4 is a perspective diagrammatic view of the assembled embodiment of figure 1, and

- 15 Figure 5 is a perspective diagrammatic view of an embodiment of a disc section into which the embodiments of figures 3 and 4 may be fitted.

DESCRIPTION OF PREFERRED EMBODIMENT

- 20 With reference to the drawings and by way of example only, figure 1 illustrates a tip portion, generally indicated by arrow 1. This comprises a body portion (2) and tooth portion (3). From this arrangement the entire tip portion (1) is cast as a single unit with the tooth portion (3) then machined to the general contour illustrated in figure 1.

- 25 Not clearly visible in figure 1 is the tapering of the bottom face (4) of the tip portion (1), though this is more clearly seen in figure 2. Referring to figure 1 it should be appreciated that the tapering of the bottom face (4) of tip portion (1) is comparable and substantially complementary to the tapering of the top face (6) of base or wedge portion (5).

The base portion (5) allows the tip portion (1) to be mounted into a suitable locating aperture in a grinding disc, drum, or part thereof. This may be a blind hole drilled into the grinding

disc etc. It is envisaged that the embodiment of figure 1 is more likely to be used in an arrangement where it represents a circumferential tooth on a grinding disc. This allows a further aperture to be drilled from the front through to the rear face of the grinding disc to accommodate locating pin (8) which passes through said aperture of the disc and through provided aperture (7) within the base or portion (5). A threaded aperture (9) within the retaining pin (8) allows the threaded end (11) of retaining bolt (12) to be fastened therein.

The retaining bolt (12) passes through an aperture (14) in the body (2) of tip portion (1). In practice a wedge keeper (15) sits between the head (16) of the retaining bolt (12) and the body (2) of the tip portion (1). This wedge shape keeper fits into an appropriately shaped recess (17) provided in the body (2) of tip portion (1). The inner most contacting walls (20, 21) of the keeper (15) are inclined downwardly and outwardly and correspond to an inclination on the walls (22, 23) of the recess (17) provided in the tip body portion (1). As previously mentioned in the specification the result of this tapering is that pushing the keeper (15) downwardly will attempt to also move it outwardly.

Figure 4 shows the embodiment of figure 1 once it has been assembled. Figure 5 illustrates a section of a grinding disc into which the completed assembly (25) is mounted. In practice tightening the bolt (16) pushes the keeper (15) outwardly against the inner wall of the accommodating aperture (51) for the assembly (25). Further tightening also tends to displace the body portions (2 and 5) outwardly further wedging the assembly (25) within the provided aperture (51). The presence of retaining pin (8) in aperture 52 also further secures the assembly (25) against removal from the element (50) in which it is fastened, as well as also preventing its rotation.

In figure 2 we can see a slightly different embodiment of the present invention where two identical tip portions (1a, 1b) are used end to end. In this case the tapering of bottom face (4) remains the same. The use of keeper (15) also remains the same. The only difference is that a base portion (5) of figure 1 has been replaced by an identical tip portion (1b).

A retaining bolt (12) is still relied upon to secure the two portions together, the difference being that instead of a retaining pin (8) a nut (30) with optional washer is used.

The completed arrangement can be clearly seen in figure 3. This type of arrangement is best used in the situation where the tooth is to be mounted such that one tooth is present on

opposing faces of grinding equipment – such as a disc or section (50) thereof. In this arrangement rotation within the provided aperture (54) for assembly (35) is possible. However rotation is minimised by the fact that tightening the bolt (12) serves to press the keeper (15) and outer walls (31, 32) of the body portions (2, 34) apart. This effectively
5 wedges or jams the assembly (35) within the provided aperture (54) making rotation difficult. If necessary, suitable modification may be made by merely loosening the retaining bolts (12) rotating the assembly (35) to the correct orientation, then retightening bolt (16).

In practice the present invention can provide a number of potentially realisable advantages over the prior art. For instance the generally simpler design should provide manufacturing
10 advantages over the prior art. As simplicity of design is also more ideally suited to the type of environment in which it is likely to be used, it can thus become a more readily expendable or replaceable item. The design also allows for much quicker replacement of components, ready removal, or changing of orientation, as may be required.

Aspects of the present invention have been described by way of example only and it should
15 be appreciated that modifications and additions may be made thereto without departing from the spirit or scope of the present invention as described herein.

It should also be understood that the term “comprise” where used herein is not to be considered to be used in a limiting sense. Accordingly, ‘comprise’ does not represent nor define an exclusive set of items, but includes the possibility of other components and items
20 being added to the list.

This specification is also based on the understanding of the inventor regarding the prior art. The prior art description should not be regarded as being authoritative disclosure on the true state of the prior art but rather as referencing considerations brought to the mind and attention of the inventor when developing this invention.

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RODNEY WARWICK SHARP
By his Attorneys

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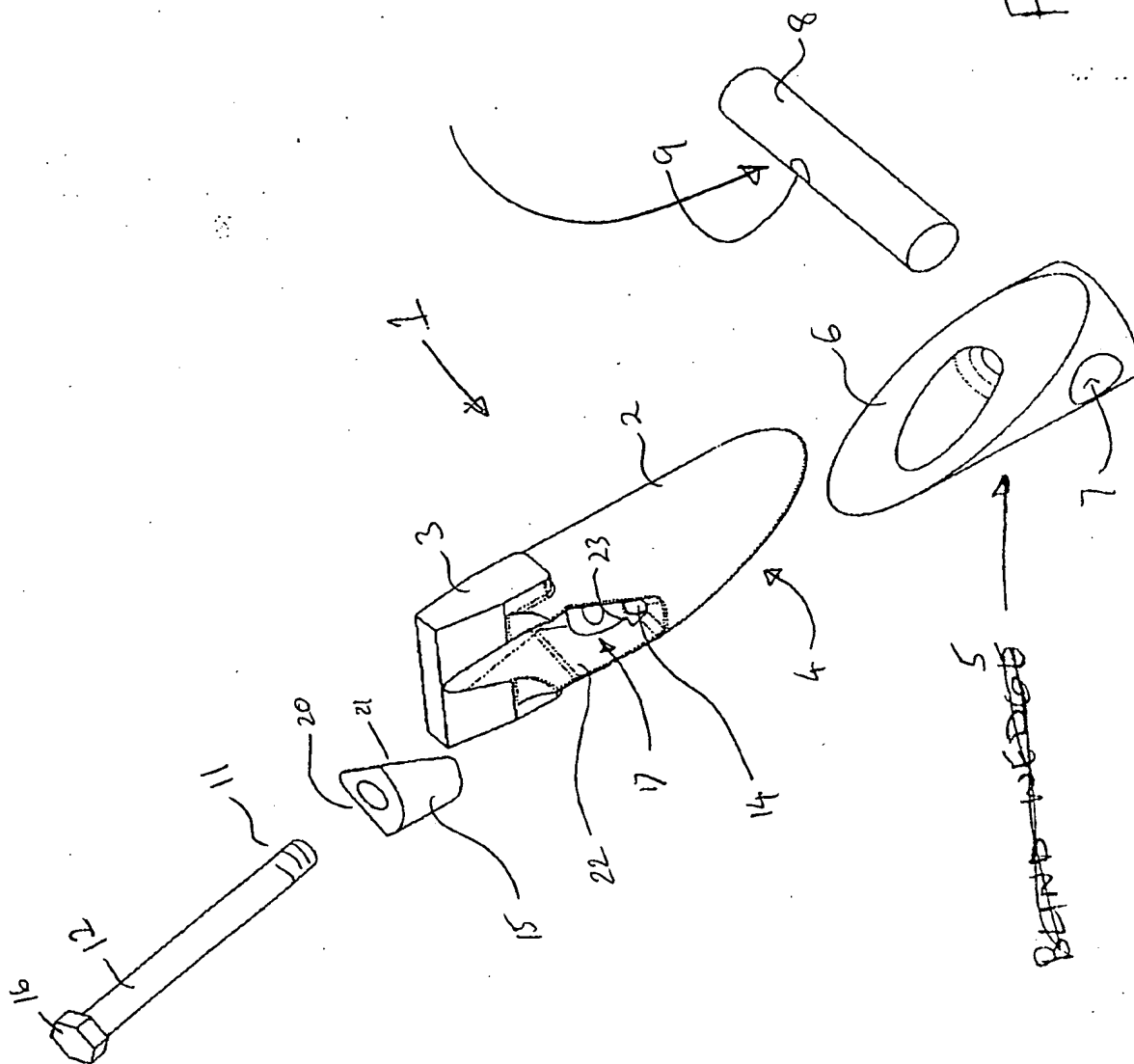


FIG 1

~~BEHOLDING~~ 5

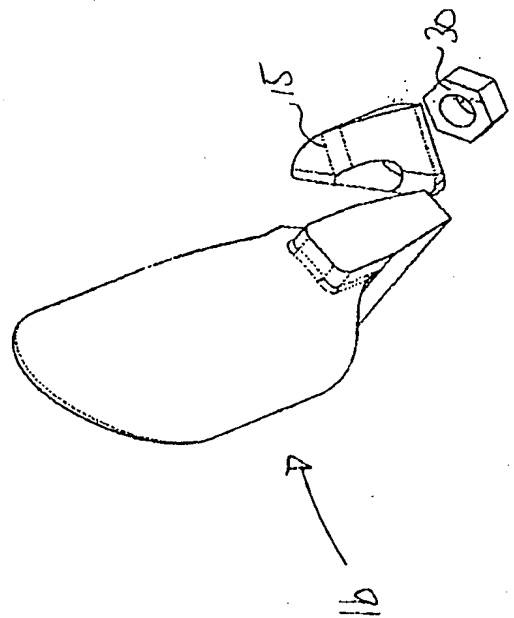
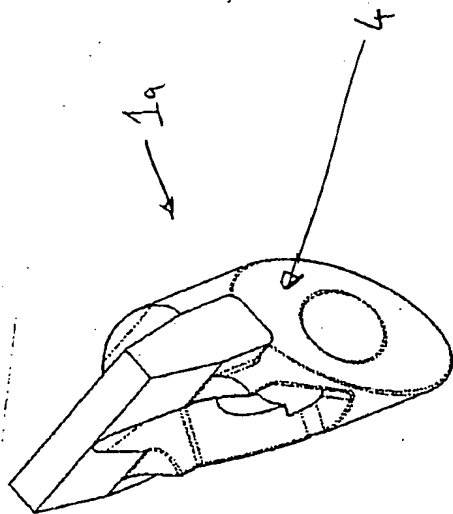
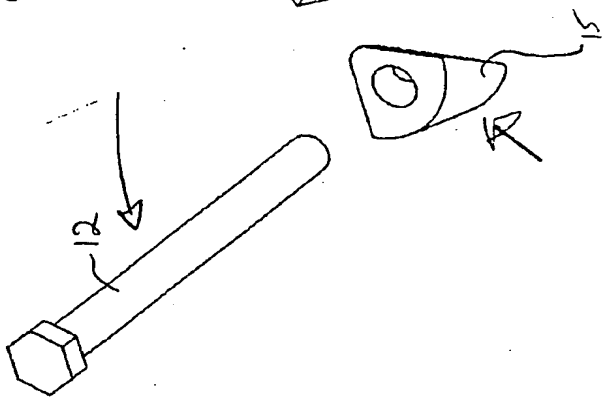


FIG 2

OUTER TOOTH

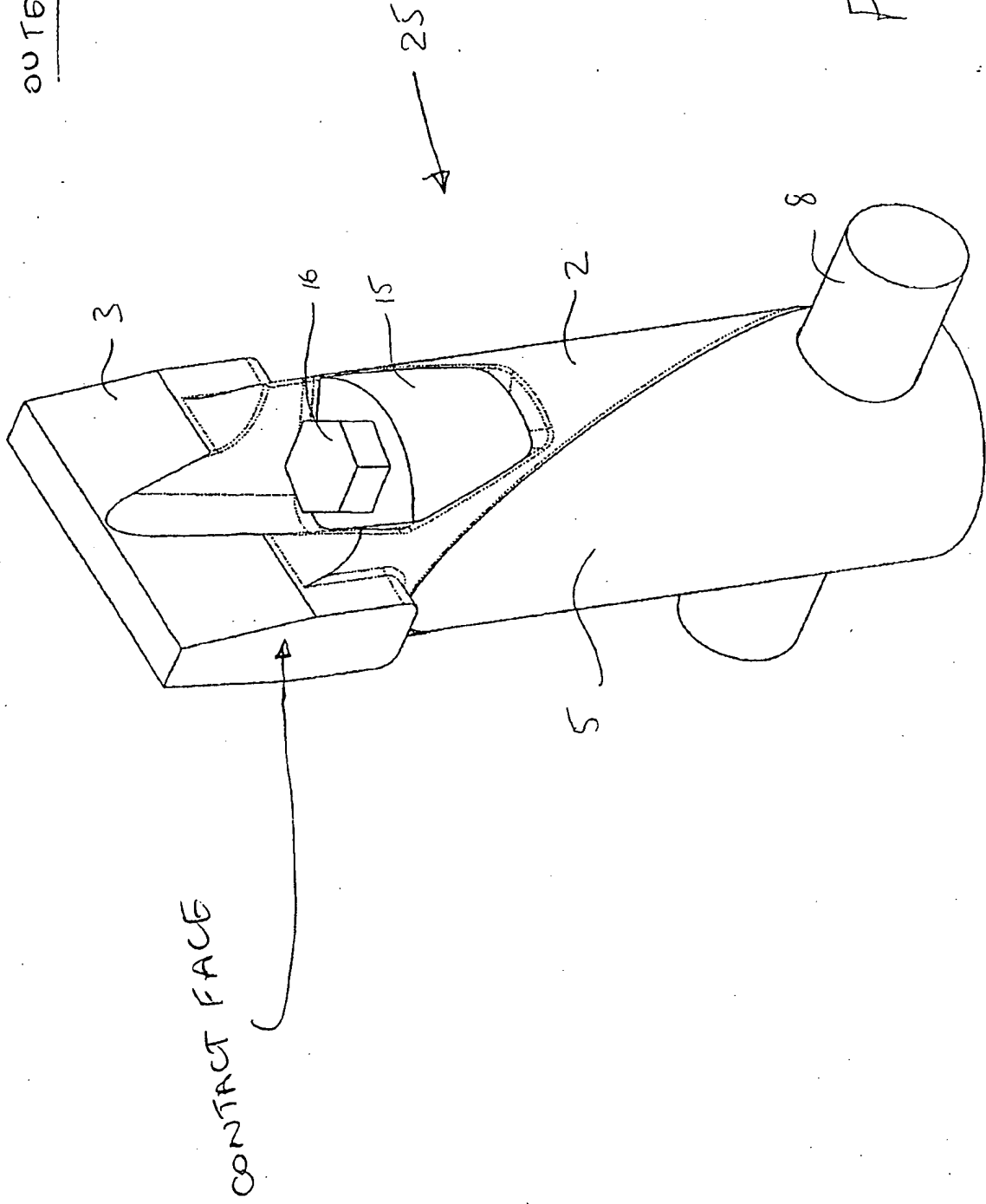


FIG 4

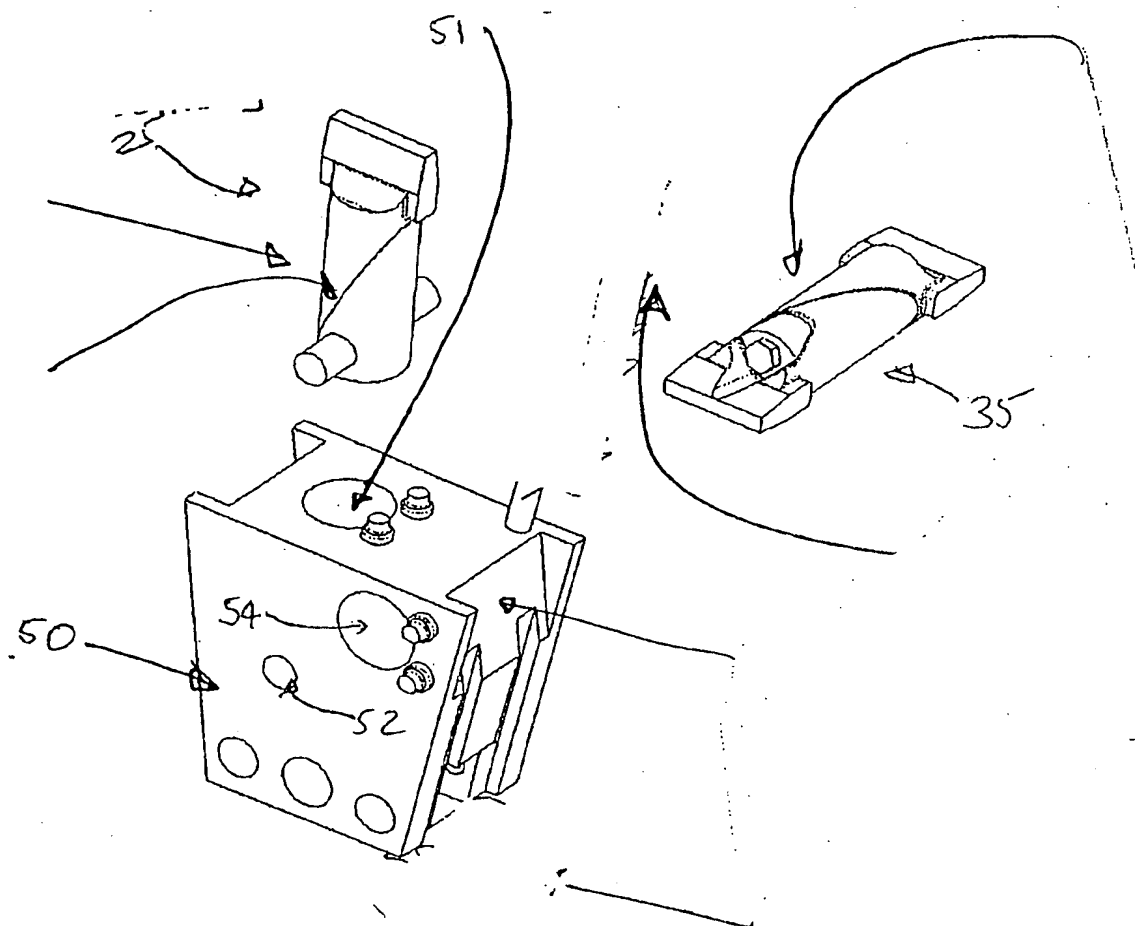


FIG 5